Supplementary Material

**List of plans analysed**

**Victoria – non Murray Darling Basin**

* Moorabool River Environmental Water Management Plan (EWMP) 2016
* Moorabool River Flows study 2015
* Moorabool River Seasonal Watering Proposal 2019/2020
* Upper Barwon River Seasonal Watering Proposal 2019/2020
* Upper Barwon Yarrowee Leigh Flows study 2019
* Glenelg River Seasonal Watering Proposal 2017/2018
* Glenelg River Seasonal Watering Proposal 2018/2019
* Upper and Mid Glenelg Flows study 2013
* Lower Glenelg Flows study 2018
* Glenelg River Environmental Water Management Plan (EWMP) 2016
* Tarago-Bunyip Environmental Water Management Plan (EWMP) 2017
* Werribee River Environmental Water Management Plan (EWMP) 2015
* Yarra River Flows study 2018
* Tarago and Bunyip Rivers Flows study 2018
* Cement Creek Flows study 2020
* Macalister River EWMP 2015
* LaTrobe River Seasonal Watering Proposal 2019/2020
* Thompson River Seasonal Watering Proposal 2019/2020

**Murray Darling Basin**

**Victoria**

* Goulburn River Environmental Water Management Plan (EWMP) 2015
* Goulburn River Seasonal Watering Proposal 2019/2020
* Lower Goulburn River Flows study 2020 (draft)
* Broken River Environmental Water Management Plan (EWMP) 2013
* Broken Creek and Nine Mile Environmental Water Management Plan (EWMP) 2010
* Murray River Lock 6 - 10 Environmental Water Management Plan (EWMP) 2015
* Murray River Lock 5 Environmental Water Management Plan (EWMP) 2015
* Campaspe River Environmental Water Management Plan (EWMP) 2014
* Gunbower Creek and lagoon system Environmental Water Management Plan (EWMP) 2015
* Loddon River Environmental Water Management Plan (EWMP) and Flows study 2015
* Coliban River Environmental Water Management Plan (EWMP) 2015
* Birch (Bullarook) Creek Environmental Water Management Plan (EWMP) 2015
* Pyramid Creek Flows study 2015
* Serpentine Creek Flows 2014
* Ovens River EWMP 2015
* Wimmera Seasonal Watering Proposal 2018/2019

**South Australia**

* South Australia Murray River Environmental water plan 2018/2019
* South Australia Murray Darling Basin NRM Plan 2015
* River Murray Channel Environmental Water Requirements: Ecological Objectives and Targets 2014

**New South Wales**

* NSW Government River Flow objectives 1999 (12 overarching objectives for the protection or restoration of river health, ecology and biodiversity)
* Water Sharing Plan for the Lachlan Regulated River Water Source 2016
* Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016
* Murrumbidgee Long Term Water Plan 2019 (Draft)
* Murray-Lower Darling Long Term Water Plan 2019 (Draft)
* Lachlan Long Term Water Plan 2019 (Draft)

**Commonwealth Government**

* The Basin Plan 2012

**Examples of existing objectives that include recommended climate change adaptations as per Table 1.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Suggested objectives that incorporate climate change adaptations (from Table 1) | Number of existing objectives that meet this adaptation | Examples of existing objectives from case study documents  |
| ***Persistence - Aims to maintain habitats and features, including refuges*** |
| 1  | Maintain key ecosystem features that can support and underpin the overall system e.g. buffer zones, riparian areas incorporating drought tolerant plants, structural complexity of vegetation, protect nursery and spawning areas (West et al, 2009) | 158 | “*Protect and restore the key species, habitat components and functions of the ecosystem by providing the hydrological environments required by indigenous plant and animal species and communities*” (Murray River Lock 6-10 EWMP 2015)“*Maintain or improve in-stream & riparian vegetation extent, structure & composition*” (Yarra River Flows study 2018)“*Trigger downstream spawning migration of adult catadromous and amphidromous fish*” (Moorabool River EWMP 2016)“*Provide flows cues by increasing water depth to promote downstream migration and spawning for Australian grayling, tupong and Australian bass*” (Macalister River EWMP 2015) |
| 2  | Considers drought induced low flows or provision or maintenance of refuge or pool habitat for low flow/drought conditions  | 11 | “*Provide adequate water quality/habitat for fish refuge locations in dry periods*”. (Wimmera SWP 2018/19) “*Protection of drought refuge plus dry spell breaking under climate change conditions*” (Broken and Nine Mile EWMP 2010) “*To protect refugia in order to support the long-term survival and resilience of water-dependent populations of native flora and fauna, including during drought to allow for subsequent re-colonisation beyond the refugia*”. (The Basin Plan 2012) “*Flush pools to prevent water quality decline during low flows*” (Glenelg River SWP 2017-18) |
| 3 | Seeks to maintain ecological outcomes rather than restore to an historic state (e.g. uses maintain rather than restore/protect)  | 182 | “*Provide flow variability to maintain species diversity of fringing vegetation*” (Moorabool River EWMP 2016)“*Maintain high species richness and abundance of fish populations in the upper reaches*” (Werribee River EWMP 2015)“*Maintain current macroinvertebrate community (including benthic invertebrates, crayfish and mussels)*” (Cement Creek Flows 2020) |
| ***Adaptation - Provides for improved migration and maintenance of ecological function*** |
| 4 | Considers habitat diversity, connectivity and/or conservation | 98 | “*Increase instream physical habitat diversity (e.g. shallow and deep water habitats)*” (Goulburn River EWMP 2015)“*Provide baseflow adequate to allow the persistence of aquatic macrophytes at the bank toe*.” (Broken River EWMP 2013)“*Maintaining passage for migratory fish moving between the estuary and the upper reaches*” (Tarago-Bunyip EWMP 2017)“*Disturb the algae/bacteria/organic biofilm present on rock or wood debris to support macroinvertebrate communities*.” (Wimmera SWP 2018/19)*“Create quality instream, floodplain and wetland habitat - regulation of DO, temp and salinity, provision of diverse wetted areas and geomorphic processes, control encroachment of terrestrial vegetation, appropriate rates of rise and fall*” (Murray-Lower Darling Long Term Water Plan 2019) |
| 4  | Encourages increased movement of species (e.g. to new habitats within an acceptable thermal tolerance range) | 48 | *“Maintaining a viable breeding population of platypus along Serpentine Creek that can disperse to tributaries and contribute to a larger regional metapopulation”* (Serpentine Creek Flows study 2014)“*Provide movement and dispersal opportunities for biota to complete lifecycles and disperse into new habitats lifecycles - within and between catchments - including migration for full life cycle, recolonisation following disturbance, dispersal of eggs, larvae and seeds”* (Murrumbidgee Long Term Watering plan 2019) |
| 5 | Aim to maintain a diversity of species, without mention of specific species  | 84 | “*Maintain abundance, improve breeding and recruitment of macroinvertebrates as a food source for fish, frog and platypus populations*” (Upper Barwon River SWP 2019/20)“*Provide periodic opportunities for regeneration of riparian, floodplain and wetland plant species and improve in channel carbon availability*” (Goulburn River SWP 2019/20)“*Maintaining the full suite of native migratory and non-migratory fish species*” (Tarago-Bunyip EWMP 2017)  |
| 6 | Ensure carbon cycling and energy sources for aquatic and riparian productivity are maintained | 18 | *Provide for the mobilisation of carbon and nutrients from the floodplain to the river to reduce the reliance of instream food webs on autochthonous productivity.* (River Murray Channel Environmental Water Requirements: Ecological Objectives and Targets 2014)*Protect and restore ecological community structure, species interactions and food webs that sustain water-dependent ecosystems, including by protecting and restoring energy, carbon and nutrient dynamics, primary production and respiration.* (The Basin Plan, 2012) *Support nutrient, carbon and sediment transport along channels and benches/banks, and between channels and floodplains/wetlands* (Murrumbidgee Long Term Water Plan, 2019)  |
| 7 | Aim for high functional redundancy and diversity within an ecosystem  | 19 | “*Maintain or improve condition, extent and diversity of emergent macrophyte vegetation to provide structural habitat and channel/lower bank stability to low and moderate flows.*” (Upper Barwon Rv SWP 2019/20)“*Maintain/increase diversity and productivity of macroinvertebrates and macroinvertebrate functional feeding groups”* (Campaspe River EWMP 2014) |
| ***Transformation – Objectives that actively promote change and/or are flexible to change*** |
| 8 | Objectives that are flexible, and achievable, with changing water availability  | 9 | “*Maintain water rats as a component of the system and accept their numbers will fluctuate between drought and non-drought conditions*”(Loddon River EWMP 2015) “*water-dependent ecosystems are resilient to climate change, climate variability and disturbances (for example, drought and fire)”* (The Basin Plan, 2012) |
| 9  | Allow the establishment of locally non native species that maintain native biodiversity or ecosystem function in the overall region (West et al, 2009)  | 13 | This included objectives with generic terms such as:“*To protect, restore and enhance its ecological health, functioning, and biodiversity of the Werribee River*” (Werribee River EWMP 2015)“*Maintain/increase diversity and productivity of macroinvertebrates and macroinvertebrate functional feeding groups*” (Cement Creek flows study 2020) *“Maximise structural complexity and diversity of floodplain vegetation, including wetlands*” (Goulburn River flows study 2020)  |
| 10  | If there was any suggestion for ex situ conservation or active translocation | 0 | There were no suggestions on active movement of species from one catchment to another or conservation of a species in a non natural setting  |